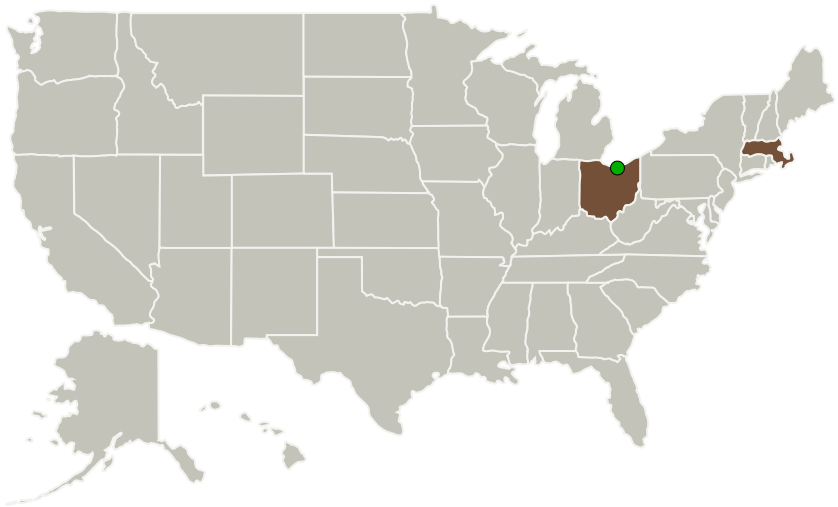
# 20mN, Variable Specific Impulse Colloid Thruster, Phase I

Completed Technology Project (2011 - 2011)

## Project Introduction

Colloid thrusters have long been known for their exceptional thrust efficiency and ability to operate over a range of specific impulse due to easily variable charge-to-mass ratio of emitted particles. They have also been considered limited to only very low thrust levels, able to produce few microNewtons from individual emission sites. This has motivated significant research into developing large microfabricated arrays of emitters in order to achieve greater thrust. Busek, using an alternate approach, avoids the complications of large emitter arrays while obtaining about 2.5 milliNewtons/cm2 and about 13,000 emission sites/cm2, and has proven this at the 0.1mN thrust level for over 450 operating hours. Combined with colloids' variable Isp capabilities and thrust/power superior to other electric propulsion devices, these new, high thrust colloid thrusters promise to enable new classes of missions benefiting from variable Isp of 200-5000s (or greater) and variable thrusts up to and exceeding 20mN. For the Phase I effort, Busek shall perform a proof-of-concept demonstrating scalability of its proven 0.1mN, cylindrical emitter into a swept linear or annular configuration (to increase emission area while preserving the cross-section), resulting in a 5mN prototype. For the subsequent Phase II, the emitter will be scaled up to 20mN and packaged and tested with fully integrated propellant storage/feedsystem and electronics.

## Primary U.S. Work Locations and Key Partners

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## Table of Contents

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Busek Company, Inc. | Lead Organization | Industry<br>Women-Owned Small Business (WOSB) | Natick, Massachusetts |
| Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |

| Primary U.S. Work Locations | |
|---|---|
| Massachusetts | Ohio |

## Project Transitions

**February 2011:** Project Start

**September 2011:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/140209)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Busek Company, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Nathaniel Demmons

**Co-Investigator:**

Nathaniel Demmons

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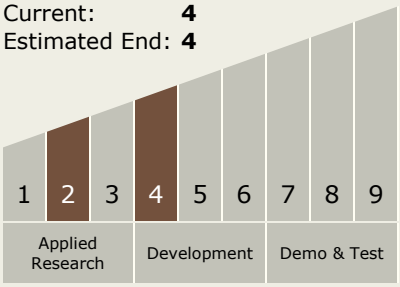
## Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**




## Technology Areas

**Primary:**

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System